Financial management
L. Fung
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Undergraduate study in
Economics, Management,
Finance and the Social Sciences

This is an extract from a subject guide for an undergraduate course offered as part of the University of London International Programmes in Economics, Management, Finance and the Social Sciences. Materials for these programmes are developed by academics at the London School of Economics and Political Science (LSE).

For more information, see: www.londoninternational.ac.uk
The 2015 edition of this guide was prepared for the University of London International Programmes by:

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It is a revised edition of previous editions of the guide prepared by J. Dahya and R.E.V. Groves, and draws on the work of those authors.

This is one of a series of subject guides published by the University. We regret that due to pressure of work the author is unable to enter into any correspondence relating to, or arising from, the guide. If you have any comments on this subject guide, favourable or unfavourable, please use the form at the back of this guide.
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AC3059 Financial management is a 300 course offered on the degrees and diplomas in Economics, Management, Finance and the Social Sciences (EMFSS) suite of programmes awarded by the University of London International Programmes.

Financial management is part of the decision-making, planning and control subsystems of an enterprise. It incorporates the:

- treasury function, which includes the management of working capital and the implications arising from exchange rate mechanisms due to international competition
- evaluation, selection, management and control of new capital investment opportunities
- raising and management of the long-term financing of an entity
- need to understand the scope and effects of the capital markets for a company
- need to understand the strategic planning processes necessary to manage the long and short-term financial activities of a firm.

The management of risk in the different aspects of the financial activities undertaken is also addressed.

Studying this course should provide you with an overview of the problems facing a financial manager in the commercial world. It will introduce you to the concepts and theories of corporate finance that underlie the techniques that are offered as aids for the understanding, evaluation and resolution of financial managers’ problems.

This subject guide is written to supplement the Essential and Further reading listed for this course, not to replace them. The aim of the course is to provide an understanding and awareness of both the underlying concepts and practical application of the basics of financial management. The subject guide and the readings should also help to build in your mind the ability to make critical judgments of the strengths and weaknesses of the theories, just as it should be helping to build a critical appreciation of the uses and limitations of the same theories and their possible applications.

Aims and objectives

This course aims to cover the basic building blocks of financial management that are of primary concern to corporate managers, and all the considerations needed to make financial decisions both inside and outside firms.

This course also builds on the concept of net present value and addresses capital budgeting aspects of investment decisions. Time value of money is then applied to value financial assets, before extensively considering the relationship between risk and return. This course also introduces the theory and practice of financing and dividend decisions, cash and working capital management and risk management. Business valuation and mergers and acquisitions will also be discussed.
By the end of this course and having completed the Essential reading and activities, you should be able to:

**Subject-specific objectives**
- describe how different financial markets function
- estimate the value of different financial instruments (including stocks and bonds)
- make capital budgeting decisions under both certainty and uncertainty
- apply the Capital Assets Pricing Model in practical scenarios
- discuss the Capital Structure Theory and dividend policy of a firm
- estimate the value of derivatives and advise management how to use derivatives in risk management and capital budgeting
- describe and assess how companies manage working capital and short-term financing
- discuss the main motives and implications of mergers and acquisitions.

**Intellectual objectives**
- integrate subject matter studied on related modules and to demonstrate the multi-disciplinary aspect of practical financial management problems
- use academic theory and research to question established financial theories.

**Practical objectives**
- be more proficient in researching materials on the internet and Online Library
- be able to use Excel for statistical analysis.

**Syllabus**

The subject guide examines the key theoretical and practical issues relating to financial management. The topics to be covered in this subject guide are organised into the following 20 chapters:

**Chapter 1: Financial management function and environment**
This chapter outlines the fundamental concepts in financial management and deals with the problems of shareholders’ wealth maximisation and agency conflicts.

**Chapter 2: Investment appraisals 1**
In this chapter we begin with a revision of investment appraisal techniques. The main focus of this chapter is to examine the advantages of using the discounted cash flow technique and its application in basic investment scenarios.

**Chapter 3: Investment appraisals 2**
This chapter follows on from Chapter 2 to explore the application of the discounted cash flow technique in more complex scenarios: capital rationing, price changes and inflation, and tax effect.

**Chapter 4: Investment appraisals 3**
This chapter illustrates the application of the discounted cash flow technique in further complex scenarios: replacement decision, project deferment and sensitivity analysis.
Chapter 5: Risk and return
We formally examine the concept and measurement of risk and return in this chapter. We also look at the necessary conditions for risk diversification, Portfolio Theory and the Two Fund Separation Theorem. Asset Pricing Models are discussed and practical considerations in estimating beta will be covered. Empirical evidence for and against the Asset Pricing Models will also be illustrated.

Chapter 6: Portfolio Theory and Capital Assets Pricing Model
This chapter introduces more formally the Portfolio Theory and discusses the derivation of the Capital Assets Pricing Model.

Chapter 7: Practical consideration of the Capital Assets Pricing Model and Alternative Asset Pricing Model
Following on from Chapter 6 we examine the techniques for estimating betas and their conceptual and practical considerations. We also introduce an Alternative Pricing Model based on the Arbitrage Pricing Model.

Chapter 8: Capital market efficiency
This chapter discusses the concepts and implications of market efficiency and the mechanism of equity and debt issuance.

Chapter 9: Sources of finance – Equity
In this chapter we focus on how companies raise funds from the stock and bond markets, and discuss the advantages and disadvantages of this financing method.

Chapter 10: Sources of finance – Debt
In this chapter we focus on how companies raise funds from the bond markets, and discuss the advantages and disadvantages of this financing method.

Chapter 11: Capital structure 1
This chapter introduces the arguments of Modigliani and Miller on capital structure, and discuss the implication of the Trade-off Theory.

Chapter 12: Capital structure 2
This chapter critically reviews the existing leading theories of capital structure. Specifically, signalling effect, agency cost of equity and debt, and the Pecking Order Theory will be examined. We will also evaluate the practical considerations of capital structure decisions made by corporate managers.

Chapter 13: Dividend policy
This chapter aims to explore how the amount of dividend paid by corporations would affect their market values. The tax, signalling and agency effects of dividend will be discussed.

Chapter 14: Cost of capital and capital investments
In this chapter we discuss how the cost of capital can be adjusted when firms are financed with a mixture of debt and equity.

Chapter 15: Valuation of business
We introduce the valuation of equity, debt, convertibles and warrants in this chapter.

Chapter 16: Mergers
This chapter focuses on the theory and motives of mergers and acquisitions. The determination of merger value and the defensive tactics
against merger threats will also be covered. The empirical evidence of
using financial ratios to predict mergers and acquisitions will be discussed.

Chapter 17: Financial planning
This chapter focuses on the importance of careful financial planning
and examines and evaluates the approaches to and methods of financial
planning.

Chapter 18: Working capital management
The importance of managing working capital will be discussed in this
chapter.

Chapter 19: Risk management – concepts and instruments for
risk hedging
This chapter provides an introduction to risk management, including: the
concepts of risk management and the use of derivatives in hedging.

Chapter 20: Risk management – applications
This chapter discusses the techniques commonly used in risk hedging.

Reading

Essential reading
referred to as BMA, this textbook deals with most of the topics covered in
this subject guide.

Detailed reading references in this subject guide refer to the edition of the
set textbook listed above. New editions of this textbook may have been
published by the time you study this course. You can use a more recent
edition of this book or of any of the books listed below; use the detailed
chapter and section headings and the index to identify relevant readings.
Also check the VLE regularly for updated guidance on readings.

Further reading
Please note that as long as you read the Essential reading you are then free
to read around the subject area in any text, paper or online resource. You
will need to support your learning by reading as widely as possible and by
thinking about how these principles apply in the real world. To help you
read extensively, you have free access to the virtual learning environment
(VLE) and the University of London Online Library (see below).

Other useful texts for this course include:
Arnold, G. Corporate financial management. (Harlow: Financial Times/Prentice
ARN, this textbook also covers most of the topics in this subject guide. It is
less technical than BMA.

[ISBN 9780321127211]. This is a classic finance textbook pitched at an
advanced level. You may use this textbook for reference as it contains some
useful updates of empirical studies in the field of corporate finance.

Watson, D. and A. Head Corporate finance passnotes. (Harlow: Pearson
of a passnote neatly summarises the key concepts in financial management.
You might find it useful as a revision tool.

Apart from the above textbooks, this subject guide also refers to some of
the original articles from which the financial management theories are
developing. You should refer to the works cited in each chapter for the full reference of these articles.

How to use the subject guide

This subject guide is meant to supplement but not to replace the main textbook. You should use it as a guide to devise a plan for your own study of this subject. Suggested here is one approach to using this subject guide.

Approach financial management in the same order as the chapters in this subject guide. It is specifically designed to help you build up your understanding of the subject.

1. For each chapter (apart from this Introduction) you should familiarise yourself with the aim and outcomes before reading the materials.
2. Read the introductory section of each chapter to identify the areas you need to focus on.
3. Carefully read the suggested chapters in BMA, with the aim of gaining an initial understanding of the topics.
4. Read the remainder of the chapter in the subject guide. You may then approach the Further reading suggested in the subject guide and BMA.
5. The subject guide is designed to set the scope of your studies of this topic as well as to attempt to reinforce the basic messages set out in BMA. Therefore you should pay careful attention to the examples in both the texts and the subject guide to ensure you achieve that basic understanding. By taking notes from BMA, and then from other books you should have obtained the necessary material for your understanding, application and later revision.
6. Pay particular attention to the practice questions and the examples given in the subject guide. The material covered in the examples and in the Activities complements the textbook and is important in your preparation for the examination.
7. Ensure you have achieved the listed learning outcomes.
8. Attempt the Sample examination questions at the end of each chapter and the quizzes on the virtual learning environment (VLE).
9. Check you have mastered each topic before moving on to the next.
10. At the end of your preparations, attempt the questions in the Sample examination paper at the end of the subject guide. Then compare your answers with the suggested solutions, but do remember that they may well include more information than the Examiner would expect in an examination paper, since the guide is trying to cover all possible angles in the answer, a luxury you do not usually have time for in an examination.

Online study resources

In addition to the subject guide and the Essential reading, it is crucial that you take advantage of the study resources that are available online for this course, including the VLE and the Online Library.

You can access the VLE, the Online Library and your University of London email account via the Student Portal at: http://my.londoninternational.ac.uk

You should have received your login details for the Student Portal with your official offer, which was emailed to the address that you gave on
your application form. You have probably already logged in to the Student Portal in order to register. As soon as you registered, you will automatically have been granted access to the VLE, Online Library and your fully functional University of London email account.

If you have forgotten these login details, please click on the ‘Forgotten your password’ link on the login page.

The VLE

The VLE, which complements this subject guide, has been designed to enhance your learning experience, providing additional support and a sense of community. It forms an important part of your study experience with the University of London and you should access it regularly.

The VLE provides a range of resources for EMFSS courses:

• Self-testing activities: Doing these allows you to test your own understanding of subject material.
• Electronic study materials: The printed materials that you receive from the University of London are available to download, including updated reading lists and references.
• Past examination papers and Examiners’ commentaries: These provide advice on how each examination question might best be answered.
• A student discussion forum: This is an open space for you to discuss interests and experiences, seek support from your peers, work collaboratively to solve problems and discuss subject material.
• Videos: There are recorded academic introductions to the subject, interviews and debates and, for some courses, audio-visual tutorials and conclusions.
• Recorded lectures: For some courses, where appropriate, the sessions from previous years’ Study Weekends have been recorded and made available.
• Study skills: Expert advice on preparing for examinations and developing your digital literacy skills.
• Feedback forms.

Some of these resources are available for certain courses only, but we are expanding our provision all the time and you should check the VLE regularly for updates.

Making use of the Online Library

The Online Library contains a huge array of journal articles and other resources to help you read widely and extensively.

To access the majority of resources via the Online Library you will either need to use your University of London Student Portal login details, or you will be required to register and use an Athens login: http://tinyurl.com/ollathens

The easiest way to locate relevant content and journal articles in the Online Library is to use the Summon search engine.

If you are having trouble finding an article listed in a reading list, try removing any punctuation from the title, such as single quotation marks, question marks and colons.

For further advice, please see the online help pages: www.external.shl.lon.ac.uk/summon/about.php
Unless otherwise stated, all websites in this subject guide were accessed in June 2012. We cannot guarantee, however, that they will stay connected and you may need to perform an internet search to find the relevant pages.

**Examination advice**

**Important:** the information and advice given here are based on the examination structure used at the time this guide was written. Please note that subject guides may be used for several years. Because of this we strongly advise you to always check both the current Regulations for relevant information about the examination, and the VLE where you should be advised of any forthcoming changes. You should also carefully check the rubric/instructions on the paper you actually sit and follow those instructions.

The examination paper consists of eight questions of which you must answer four questions. Each question carries equal marks and is divided into several parts. The style of question varies but each question aims to test the mixture of concepts, numerical techniques and application of each topic. Since topics in financial management are often interlinked, it is inevitable that some questions might examine overlapping topics.

Remember when sitting the examination to maximise the time spent on each question and although, throughout, the subject guide will give you advice on tackling your examinations, remember that the numerical type questions on this paper take some time to read through and digest. Therefore try to remember and practise the following approach. Always read the requirement(s) of a question first before reading the body of the question. This is appropriate whether you are making your selection of questions to answer, or when you are reading the question in preparation for your answer.

In the question selection process at the start of the examination, by reading only the requirements, which are always placed at the end of a question, you only read material relevant to your choice, you do not waste time reading material you are not going to answer. Secondly, by reading the requirements first, your mind is focused on the sort of information you should be looking for in order to answer the question, therefore speeding up the analysis and saving time.

Remember, it is important to check the VLE for:

- up-to-date information on examination and assessment arrangements for this course
- where available, past examination papers and Examiners' commentaries for the course which give advice on how each question might best be answered.

**Summary**

Remember this introduction is only a complementary study tool to help you use this subject guide. Its aim is to give you a clear understanding of what is in the subject guide and how to study successfully. Systematically study the next 20 chapters along with the listed texts for your desired success.

Good luck and enjoy the subject!
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEV</td>
<td>Annual equivalent value</td>
</tr>
<tr>
<td>AIM</td>
<td>Alternative investment market</td>
</tr>
<tr>
<td>APM</td>
<td>Arbitrage Pricing Model</td>
</tr>
<tr>
<td>ARN</td>
<td>Arnold, 2008</td>
</tr>
<tr>
<td>ARR</td>
<td>Accounting rate of return</td>
</tr>
<tr>
<td>BMA</td>
<td>Brealey, Myers and Allen</td>
</tr>
<tr>
<td>CAPM</td>
<td>Capital Asset Pricing Model</td>
</tr>
<tr>
<td>CFs</td>
<td>Cash flows</td>
</tr>
<tr>
<td>CME</td>
<td>Capital market efficiency</td>
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<tr>
<td>CML</td>
<td>Capital market line</td>
</tr>
<tr>
<td>CPI</td>
<td>Consumer price index</td>
</tr>
<tr>
<td>DFs</td>
<td>Discount factors</td>
</tr>
<tr>
<td>DPP</td>
<td>Discounted payback period</td>
</tr>
<tr>
<td>DPS</td>
<td>Dividend per share</td>
</tr>
<tr>
<td>EMH</td>
<td>Efficient Market Hypothesis</td>
</tr>
<tr>
<td>EPS</td>
<td>Earnings per share</td>
</tr>
<tr>
<td>EVA</td>
<td>Economic value added</td>
</tr>
<tr>
<td>IPO</td>
<td>Initial public offer</td>
</tr>
<tr>
<td>IRR</td>
<td>Internal rate of return</td>
</tr>
<tr>
<td>LSE</td>
<td>London Stock Exchange</td>
</tr>
<tr>
<td>MM</td>
<td>Modigliani and Miller</td>
</tr>
<tr>
<td>MVA</td>
<td>Market value added</td>
</tr>
<tr>
<td>NCF</td>
<td>Net cash flow</td>
</tr>
<tr>
<td>NPV</td>
<td>Net present value</td>
</tr>
<tr>
<td>NYSE</td>
<td>New York Stock Exchange</td>
</tr>
<tr>
<td>PE</td>
<td>Price earnings ratio</td>
</tr>
<tr>
<td>PI</td>
<td>Profitability index</td>
</tr>
<tr>
<td>PP</td>
<td>Payback period</td>
</tr>
<tr>
<td>ROA</td>
<td>Return on assets</td>
</tr>
<tr>
<td>ROC</td>
<td>Return on capital</td>
</tr>
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<td>ROE</td>
<td>Return on equity</td>
</tr>
<tr>
<td>S&amp;P</td>
<td>Standard and Poor's</td>
</tr>
<tr>
<td>Std dev</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>VLE</td>
<td>Virtual learning environment</td>
</tr>
<tr>
<td>WACC</td>
<td>Weighted average cost of capital</td>
</tr>
</tbody>
</table>
Chapter 1: Financial management function and environment

Essential reading

BMA, Chapters 1 and 2, pp.49 to 53.

Further reading

ARN, Chapter 1.

Works cited


Aims

This chapter paves the foundation for you to understand what financial management is about. In particular, we will examine the roles of financial management, the environment in which businesses are operated, and Agency Theory. More importantly we explain the two key concepts which underpin much of the theory and practice of financial management.

Learning outcomes

By the end of this chapter, and having completed the Essential reading and activities, you should be able to:

- outline the nature and purpose of financial management
- describe the general environment in which businesses operate
- explain the relationship between financial objectives and corporate strategies
- assess the impact of stakeholders on corporate strategies
- discuss the time value for money concept and the risk and return relationship.

Two key concepts in financial management

Before we look at what financial management is about, it is essential for us to understand two key concepts which lay the foundation of this subject. The two key concepts are:

i. Risk and return.

ii. Time value of money.

Risk and return

Financial markets seem to reward investors of riskier investments\(^1\) with a higher return.\(^2\) The following graph indicates this relationship.\(^3\)

\(^1\) Risk is often measured as a dispersion of the possible return outcomes from the expected mean. In Chapter 3 of this subject guide, we will more formally define the concept of risk in financial management and discuss the different methods to quantify risk.

\(^2\) Return refers to the financial reward gained as a result of making an investment. It is often defined as the percentage of value gain plus period cash flow received to the initial investment value.

\(^3\) The graph has been rescaled in log to fit the page. You should note the vast differences of the cash returns from each investment type.
Figure 1.1: The cash return from five different investments.
Source: BMA.

Suppose we invested $1 in 1925 in each of the following five portfolios:

i. the largest quoted companies in the US, Standard & Poor’s (S&P)
ii. the smallest quoted companies measured by market capitalisation in the US
iii. corporate bonds

These portfolios have different levels of perceived risk. Arguably, smaller companies have higher varying returns than larger companies. Bonds, on the other hand, are a safer investment to investors. Over time, these portfolios generate cash returns which seem to follow the same order as their respective perceived risk. This leads us to one of the axioms in financial management:

The higher the risk, the higher the expected return.

Companies and investors should therefore only consider undertaking a riskier investment provided that they are suitably and sufficiently compensated by a higher return.

Activity 1.1

What are the main reasons for smaller companies having higher perceived risk? What are the specific risks we are referring to?

See the VLE for discussion.

Time value of money

Money (i.e. cash) has different values over time. Holders of money can either spend a sum of money now or delay their consumption by investing the money in different investment opportunities until it is required.

Suppose an investor can deposit a sum of money in a bank and earn an annual interest of 5%. The value of money to this investor would then be 5% per annum. If the same investor can invest the same sum of money in a financial asset which gives a return of 10% annually, then the value of
The future return from the money invested now is based on the duration of time, the risk of the investment and inflation.

For example, $100 invested today will earn 10% per annum of return (i.e. $110 in one year’s time and $121 in two years’ time). An investor who assumes a 10% return will be indifferent between receiving $100 today and $110 in one year’s time as the two cash flows have identical value to the investor. In the time value of money terminology, the present value of $110 received in one year’s time is exactly $100. Similarly, the present value of $121 received in two years’ time is exactly $100, too.

This concept can be applied to convert future cash flows into their present values. Denote the present value of a cash flow as PV and future (t-period) value of a cash flow as FV<sub>t</sub>. The general relationship between the present and future value is:

\[ FV_t = PV(1+r)^t \]

where \( r \) is the time value of money measured as a percentage.

Re-arranging the above equation, we have:

\[ PV = \frac{FV_t}{(1+r)^t} = FV_t \times \frac{1}{(1+r)^t} \]

where \( \frac{1}{(1+r)^t} \) is the t-period discount factor.

### The nature and purpose of financial management

Having discussed the two key concepts in financial management, we can now turn our attention to the function of financial management. In general, there are three main tasks that financial managers need to undertake:

i. Investing decisions – this is how financial managers select the ‘right’ investments. This can be examined in two stages. First we look at how financial managers invest in and manage short-term working capital (this is covered in Chapter 18 of this subject guide) and then we examine how financial managers may appraise long-term investment projects.

ii. Financing decisions – this involves the choice of particular sources of funds which provide cash for investments. The key issues that financial managers should address are how:

- these sources of funds can be raised (covered in Chapters 9 and 10)
- the value of the business may be affected through the combination of different sources of funds (covered in Chapters 11 and 12)
- the sources of funds may affect the relationship between different stakeholders (covered in Chapters 11 and 12).

iii. Dividend policy – this concerns the return to shareholders (covered in Chapter 13).

So in theory and in practice, how are these decisions being considered by financial managers?

### Link between investing, financing and dividend decisions

In a perfect and complete capital market where there are no transaction costs and information is widely available to everyone, it is argued that a firm’s investing, financing and dividend decisions are not interlinked. This is known as Fisher’s Separation Theorem (Fisher, 1930). This is illustrated in the following diagram.
Figure 1.2: Fisher’s Separation Theorem.

Suppose a firm is operating in a two-period environment (period 0 – now and period 1 – in one year’s time) with an initial cash flow of $Y_0$. It has the opportunity to invest in two types of investments. The first type of project relates to investments which require an initial investment outlay ($I_i$) and deliver $CF_i$ in the next period for each investment ($i$). For example, investing $I_i$ in period 0 will produce $CF_i$ in period 1. Hereafter these types of projects are referred to as production investment projects. The second type of investment is essentially financial, which allows the firm to borrow and lend an unlimited amount at an interest rate of $r$. In this case, if a firm borrows (or lends) $W_0$ in period 0, it will pay back with interest (or receive with interest) $W_1 = W_0 (1+r)$.

**Investing decision**

What should the firm do in terms of its investments? A firm will logically rank and invest in investment projects in descending order of their profitability ($R_i$ for each $i$). A production opportunity frontier can be obtained (such as the curve $Y_0Y_1$). A firm will invest up to the point where the marginal investment $i^*$ yields a return that equals the return from the capital market (i.e. interest rate $r$). The total investment outlays – the amount represented by $C^*_0Y_0$ – is the sum $I_i$ for all $i(i = 1$ to $i^*)$. Once the investment plan is fixed, the firm will have $C^*_0$ in period 0 remaining and a cash return of $C^*_1$ in period 1.
**Dividend policy**

In this setting, how much should the firm give out as dividend to its shareholders in each period? The answer is simple. It should give out $C_0$ and $C_1$ in period 0 and 1 respectively. However, would shareholders be satisfied with these amounts in each period? Suppose we have two individual shareholders 1 and 2. Each of them has their unique utility function of consumption in each period. This can be represented by the indifference curves in Figure 1.2. Individual 1 prefers to consume less in period 0 and more in period 1 (the combination at ‘a’). Given the current firm’s dividend policy, how would he be satisfied? There are two ways to achieve it:

i. The firm will pay $C_{0, a}$ and invest any excess cash flow (i.e. $C_0^* - C_{0, a}$) at $r$ in period 0 and give out $C_1^* + (C_0^* - C_{0, a})(1 + r)$. Mathematically, it can be proved that it is equal to $C_{1, a}^*$. Therefore the firm will pay the exact dividend in each period to individual 1 as he prefers.

ii. Alternatively, the firm pays $C_0^*$ to individual 1 and he can invest any excess cash flow after his consumption in period 0 in the financial investment earning a return of $r$ and receive the same combined cash flow of $C_{1, a}^*$ in period 1.

This reasoning applies to any individual shareholders with any unique utility functions. Take Individual 2 as an example. Her consumption pattern does not match the firm’s dividend payout. Similarly there are two ways we can satisfy her consumption pattern:

i. The firm will borrow $C_{0, b} - C_0^*$ at $r$ in period 0 and pay out $C_{0, b}$ to Individual 2. In period 1, the firm will pay out $C_1^* - (C_{0, b} - C_0^*)(1 + r)$. Mathematically, it can be proved that it is equal to $C_{1, b}^*$. Therefore the firm will pay the exact dividend in each period to Individual 2.

ii. Alternatively, the firm pays $C_0^*$ to Individual 2 and she borrows any shortfall to make up to her consumption $C_{0, b}$ in period 0. In period 1, she will receive $C_1^*$ less the loan and interest she takes out in period 0. This will leave her with a net amount exactly equal to $C_{1, b}^*$.

The above argument indicates that financial managers do not need to consider shareholders’ consumption patterns when fixing the investment plan or the dividend policy. The easiest way is to maximise the firm’s cash flows and distribute the spare cash flows as dividends. Shareholders will use the capital markets to facilitate their consumption patterns accordingly.

**Financing decision**

In the beginning, we assume that the firm has an initial cash flow of $Y_0$ and requires a total investment outlay of $C_{0, Y_0}$. If any part of $Y_0$ is not contributed by shareholders, the firm’s dividend in period 1 will be reduced by the funds raised from borrowing (at a cost of $r$) and the interest. However, shareholders can offset this shortfall of dividend in period 1 by investing the fund not contributed in the firm to the capital market and earn a return exactly equal to $r$.

The above argument illustrates the Fisher separation in which investing, financing and dividend decisions are all unrelated. However, if the capital market is imperfect in such a way that external funding is restricted, the Fisher separation might not apply. The following scenarios highlight the practical considerations that financial managers would need to take.
### Activity 1.2

i. Why would a firm invest up to the point where the return of the marginal investment equals the return from the capital market?

ii. What would happen to the Fisher’s separation theorem if the borrowing rate differs from the lending rate?

See the VLE for solutions.

### Corporate objectives

BMA, Chapter 1, pp.37–40 discuss the goals of corporation. The general assumption in financial management is that corporate managers will try their best to maximise the value of the shareholders' investment in the corporation (i.e. shareholders' wealth maximisation (SHWM)). Maximisation of a company's ordinary share price is often used as a surrogate objective to that of maximisation of shareholder wealth.\(^5\)

In order to achieve this objective, it is argued that corporate managers will maximise the value of all investments undertaken by the firm. This can be illustrated in the following diagram:

![Diagram](attachment:image.png)

**Figure 1.3: Shareholders’ wealth maximisation.**

Source: BMA.

---

\(^5\) Profit maximisation is not the same as shareholders' wealth maximisation. See ARN, Chapter 1, pp.3–15 for further discussion.
However, in practice, corporate objectives vary. For example, HP, a US-based computer corporation, has the following objectives listed on its website:\(^6\)

- customer loyalty
- profit
- growth
- market leadership
- leadership capability
- employee commitment
- global citizenship.

While profit maximisation, social responsibility and growth represent important supporting objectives, the overriding objective of a company must be that of shareholders' wealth maximisation. The financial wealth of a shareholder can be affected by a company's financial manager's action. Arguably, when good investment, financing and dividend decisions are made, a company's market value will increase. The rest of this subject guide will explore how financial managers' decisions can increase a firm's value.

**Activity 1.3**

Although shareholders' wealth maximisation seems to be the overriding objective, corporate managers still face a number of constraints to implement multiple objectives simultaneously.

Identify the types of constraint that corporate managers face when assessing long-term financial plans.

See the VLE for discussion.

---

**The agency problem**

The agency problem occurs when financial managers make decisions which are not consistent with the objectives of the company's stakeholders. It arises because:

1. There is a separation of ownership and control: agents (financial managers) are given the power to manage and control the company by the principals (stakeholders: shareholders, creditors and customers).
2. The goals of agents are different from those of the principals.\(^7\)
3. Principals do not get full information about their company from the agent or the market (asymmetric information).

**Activity 1.4**

What are the signs of an agency problem? What possible actions can be taken to mitigate such a problem?

See the VLE for discussion.

---

**Corporate governance and regulations**

Given the agency problem, a practical solution would be to identify a system by which companies are managed and controlled such that it focuses on:

1. the responsibilities and obligations to executive and non-executive directors
2. the relationship between firm's owners, the board of directors and the
top tier of managers.

This system, commonly known as corporate governance, is often shaped
in many different forms to respond to the different expectation from the
society and the forms of domestic stock exchanges. (See ARN, Chapter 1,
pp. 16–18 for a typical code of corporate governance.)

Financial markets

The roles of financial managers

The role of financial managers is mainly to interact with the financial
world by performing the following two tasks:
1. raising finance by selling financial claims (equity or debt)
2. advising on the use of those funds with the businesses.

A reminder of your learning outcomes

Having completed this chapter, as well as the Essential reading and
activities, you should be able to:
• outline the nature and purpose of financial management
• describe the general environment in which businesses operate
• explain the relationship between financial objectives and corporate
strategies
• assess the impact of stakeholders on corporate strategies
• discuss the time value for money concept and the risk and return
relationship.

Practice questions

1. Compute the future value of $1,000 compounded annually for:
   a. 10 years at 5%
   b. 20 years at 5%

   How would your answer to the above question be different if interest
   is paid semi-annually?

2. Compare each of the following examples to a receipt of $100,000
today:
   a. Receive $125,000 in two year's time.
   b. Receive $55,000 in one year's time and $65,000 in two year's time
   c. Receive $31,555.7 for the next 4 years, receivable at the end of
each year.
   d. Receive $10,000 for each year for an infinite period.

   Assume the interest rate is 10% per year for the foreseeable future.
Sample examination questions

1. ‘We need to maximise our profit in order for us to maximise the shareholders' wealth’ – Executive at OverHill Plc.
   Critically comment on the statement above.

2. Explain, with the aid of a diagram, how a firm's dividend policy is independent from its investment policy in a perfect and complete world.

3. Identify five different stakeholder groups of a public company and discuss their financial and other objectives.
Chapter 2: Investment appraisals

Essential reading

BMA, Chapter 2 from p.55 to the end of the chapter, and Chapter 5, pp.129–43.

Further reading

ARN, Chapter 4.

Aims

This chapter focuses on the techniques commonly used for investment appraisals in practice. In particular, we concentrate on the pros and cons of the following techniques:

- Accounting rate of return (ARR)
- Payback period (PP)
- Discounted payback period (DPB)
- Internal rate of return (IRR)
- Net present value (NPV).

Learning outcomes

By the end of this chapter, and having completed the Essential reading and activities, you should be able to:

- describe the commonly used investment appraisal techniques
- evaluate simple investment decision process.

Overview

As mentioned in Chapter 1, financial managers make decisions about which investment they should invest in to maximise their shareholders’ value. In order to do so, they need to understand how to measure the value of investments they undertake and how these investments help to improve the value of the firm. First, we will examine the basic techniques and evaluate their pros and cons in investment appraisals. We will then compare the relative merits of using NPV over IRR. Thirdly, we consider some of the scenarios when NPV can be applied to deal with the selection of investments. Finally, we discuss the problems relating to the application of these investment appraisal techniques.

Basic investment appraisal techniques

BMA, Chapter 5 reviews the appraisal techniques and explains them at great length. You should read the relevant sections of the chapter before you carry on with the rest of the material covered here.

Here we summarise these commonly used techniques.

Accounting rate of return (ARR)

The method is also known as return on capital employed (ROCE) or return on investment (ROI). It relates accounting profit to the capital invested. One widely used definition is:
ARR = \frac{\text{Average annual profit}}{\text{Average investment outlays}} \times 100\% 

Average investment takes into consideration any scrap value. It can be expressed as follows:

Average Investment = \frac{\text{Investment} - \text{Scrap value}}{2}

It measures the average net investment outlay of the project.\(^1\) Accounting profit is defined as before-tax operating cash flows after adjustment for depreciation. The decision rule is to accept investments with ARR higher than a predetermined target rate of return.

**Payback period (PP)**

Payback period measures the shortest time to recover the initial investment outlay from the cash flows generated from the investment. A company will accept an investment if the PP is less than or equal to a target period.

**Discounted payback period (DPP)**

This is similar to PP except that the cash flows from the investment are first discounted to time 0 and the shortest time to recover the initial investment outlay will then be measured.

**Internal rate of return (IRR)**

The internal rate of return on an investment or project is the annualised effective compounded return rate or discount rate that makes the net present value (NPV) of all cash flows (both positive and negative) generated from a particular investment equal to zero. The decision rule is to accept a project or investment if its IRR is higher than the cost of capital.

**Net present value (NPV)**

NPV combines the present values of all future cash flows and compares the total to the initial investment. If the NPV of a project is positive, it indicates that it earns a positive return over the cost of capital and will therefore increase the shareholders’ value. A firm should invest in all positive NPV projects, so the market value of the firm will increase by the total of the NPVs, once they are announced to the market.

To illustrate how these techniques are applied in investment appraisal, let’s look at the following example.

**Example 2.1**

Suppose we have two mutually exclusive projects, A and B. Each project requires an initial investment in a machine, payable at the beginning of year 0. There is no scrap value for these machines at the end of the project. Suppose the cost of capital (discount rate) is 20% per annum. The following before-tax operating cash flows are also known:

<table>
<thead>
<tr>
<th>Before-tax operating cash flows ($)</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project A</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>(25,000)</td>
</tr>
<tr>
<td>Project B</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>(2,500)</td>
</tr>
</tbody>
</table>

\(^1\) Some textbooks prefer to calculate ARR by referring to the average level of investment. Consequently, the average investment will be defined as \((\text{initial investment} + \text{scrap value})/2\).
**Accounting rate of return**

Suppose the profit before depreciation for each year is identical to the annual cash flow. The ARR can be determined as follows:

<table>
<thead>
<tr>
<th>Project</th>
<th>Initial investment</th>
<th>Average investment</th>
<th>Total profit after depreciation</th>
<th>Average profit</th>
<th>ARR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25,000</td>
<td>12,500</td>
<td>25,000</td>
<td>6,250</td>
<td>50%</td>
</tr>
<tr>
<td>B</td>
<td>2,500</td>
<td>2,000</td>
<td>1,250</td>
<td>417</td>
<td>33%</td>
</tr>
</tbody>
</table>

**Payback period**

We can look at the cumulative cash flow at the end of each year to determine the PP.

<table>
<thead>
<tr>
<th>Cumulative cash flows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
</tbody>
</table>

**Discounted payback period**

<table>
<thead>
<tr>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project A</strong></td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>Cash flows ($)</td>
</tr>
<tr>
<td>Discount factor (DF) (20%)</td>
</tr>
<tr>
<td>Present value</td>
</tr>
<tr>
<td>Cumulative cash flows</td>
</tr>
</tbody>
</table>

| **Project B** |
| 0 | 1 | 2 | 3 | 4 |
| Cash flows ($) | (2,500) | 2,000 | 1,500 | 250 |
| Discount factor (DF) (20%) | 1 | 0.833 | 0.694 | 0.578 | 0.482 |
| Present value | (2,500) | 1,666 | 1,041 | 144.5 |
| Cumulative cash flows | (2,500) | (834) | 207 |

For Project A, the payback period occurs in Year 4. If we assume that cash flows arrive evenly throughout the year, we can determine the approximated payback period at 5,225/9,640 = 0.54 year (i.e. PP at 3.54 years). Similarly, for Project B, the PP occurs in 1.8 years.
Net present value

The NPV can be determined as:

<table>
<thead>
<tr>
<th>Year</th>
<th>Project A</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(25,000)</td>
<td>5,000</td>
<td>10,000</td>
<td>15,000</td>
<td>20,000</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.833</td>
<td>0.694</td>
<td>0.578</td>
<td>0.482</td>
</tr>
<tr>
<td>2</td>
<td>4,165</td>
<td>6,940</td>
<td>8,670</td>
<td>9,640</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4,415</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Project B</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(2,500)</td>
<td>2,000</td>
<td>1,500</td>
<td>250</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.833</td>
<td>0.694</td>
<td>0.578</td>
</tr>
<tr>
<td>2</td>
<td>1,666</td>
<td>1,041</td>
<td>144.5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>351.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Internal rate of return

To find the IRRs of these two projects, we can use the extrapolation method. First, we recalculate the NPV of each of the two projects with a higher discount rate. For example, we choose 30% and 35% as the discount rate for Project A and B respectively. This gives, in both cases, negative NPVs.

<table>
<thead>
<tr>
<th>Year</th>
<th>Project A</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(25,000)</td>
<td>5,000</td>
<td>10,000</td>
<td>15,000</td>
<td>20,000</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.769</td>
<td>0.592</td>
<td>0.455</td>
<td>0.35</td>
</tr>
<tr>
<td>2</td>
<td>3,845</td>
<td>5,920</td>
<td>6,825</td>
<td>7,000</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(1,410)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Project B</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(2,500)</td>
<td>2,000</td>
<td>1,500</td>
<td>250</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.741</td>
<td>0.549</td>
<td>0.407</td>
</tr>
<tr>
<td>2</td>
<td>1,482</td>
<td>824</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(93)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We then substitute the relevant figures into the following equation:

\[ IRR = R^+ + \frac{NPV_{R^+} - NPV_{R^-}}{NPV_{R^+}} (R^- - R^+) \]

\( R^+ \) is the discount rate which gives a positive \( NPV_{R^+} \), \( NPV_{R^-} \)

\( R^- \) is the discount rate which gives a negative \( NPV_{R^-} \), \( NPV_{R^+} \)

Consequently, the IRRs for Project A and B are 27.6% and 31.9% respectively.
Pros and cons of investment appraisal techniques

Example 2.1 highlights the potential problems of using some of these techniques in investment appraisals. Recall the results for Projects A and B respectively:

<table>
<thead>
<tr>
<th>Projects</th>
<th>NPV</th>
<th>IRR</th>
<th>PP</th>
<th>ARR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4,415*</td>
<td>27.6%</td>
<td>2.67 years</td>
<td>50%*</td>
</tr>
<tr>
<td>B</td>
<td>351.5</td>
<td>31.9%*</td>
<td>1.33 years*</td>
<td>33%</td>
</tr>
</tbody>
</table>

* Indicates the project that will be chosen under the specific appraisal method.

Suppose the main objective is to maximise shareholders' value. Financial managers would prefer Project A as it provides a higher NPV, and hence it gives the greatest increase to the shareholders' value. However, if we choose projects based on a higher value of IRR or PP, Project B will be selected. But this project clearly does not produce the greatest value to the company. So why are these techniques still being used in practice?

**ARR**

Advantages:
- It gives a value in percentage terms which is a familiar measure of return.
- It is relatively easy to calculate compared to NPV or IRR.
- It considers the cash flows (but only after adjustment for depreciation in profit) arising from the lifetime of the project (unlike PP).
- It can be used in selecting mutually exclusive projects.

Disadvantages:
- It is very much based on the accounting profits and hence technically it does not deal with the actual cash flows arising from the project.
- It ignores the timing of the cash flows and hence it does not take into consideration the time value of money.
- It is expressed in percentage terms and therefore it does not measure the absolute value of the project. It does not indicate how much wealth the project creates.

**PP**

Advantages:
- It is computationally straightforward.
- It considers the actual cash flows, not profits, arising from a project.

Disadvantages:
- It ignores cash flows beyond the PP and hence it does not provide a full picture of a project.
- It does not consider the time value of money (even though the discounted payback period takes care of that).
- The target payback period is somehow arbitrary.
**IRR**

Advantages:
- It uses all relevant cash flows, not accounting profits, arising from a project.
- It takes into account the time value of money.
- The difference between the IRR and the cost of capital can be seen as a margin of safety.

Disadvantages:
The main limitations of using IRR in investment appraisals are that it may not give the correct decision in the following scenarios:
- when comparing mutually exclusive projects
- when projects have non-conventional cash flows
- when the cost of capital varies over time
- It discounts all flows at the IRR rate not the cost of capital rate.

**Mutually exclusive projects**
Referring to Example 2.1, Project B’s IRR is higher than that of Project A. One would rank Project B as more ‘desirable’ than Project A. However, if we consider the NPV of these projects, there is no doubt that Project A is, by far, more valuable than Project B.

**Non-conventional cash flows**
A typical investment project has an initial cash outflow followed by positive cash flows in subsequent years. However, in some cases, a project (such as oil drilling or mining) may have negative cash flows during its lifetime. Mathematically, each time the cash flow stream of a project changes sign, there is a possibility that multiple IRRs might arise.

**Example 2.2**
Suppose a project requires $100 as an initial investment. Its Year 1 and Year 2 cash flows are $260 and –$165 respectively. Based on this project’s cash flows, it produces two possible IRRs (10% or 50%):

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash flows</th>
<th>DF 50%</th>
<th>PV 50%</th>
<th>DF 10%</th>
<th>PV 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>–100</td>
<td>1</td>
<td>–100</td>
<td>1</td>
<td>–100</td>
</tr>
<tr>
<td>1</td>
<td>260</td>
<td>0.667</td>
<td>173</td>
<td>0.909</td>
<td>236</td>
</tr>
<tr>
<td>2</td>
<td>–165</td>
<td>0.445</td>
<td>–73</td>
<td>0.826</td>
<td>–136</td>
</tr>
<tr>
<td></td>
<td>Net Present Value</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Suppose the cost of capital for this project is 20%. According to the IRR rule, the project should be accepted (as the cost of capital is less than the higher IRR of 50%). However, it should also be rejected as the cost of capital is higher than the lower IRR of 10%. So for a project with non-conventional cash flows, the IRR decision is sensitive to the cost of capital. Therefore it is argued that IRR does not give an unambiguous decision when dealing with non-conventional projects.

To further illustrate this problem, let’s look at the NPV profile of the project. This depicts the relationship of the NPV of the project and its discount rate. In the above example, we know that the NPV of the project is zero at both 10% and 50%.
Suppose the cost of capital is 5%, 25% or 70%. The NPV of the project will become $-2$, $2$ and $-4$ respectively. The following diagram shows the NPV profile of the project.

We can see that, due to the non-conventional cash flow pattern, the project’s NPV varies at different discount rates. It only provides a positive NPV if the discount rate for the project’s cash flows is between 10% and 50%.

Figure 2.1: NPV profile.

However, if the project we have been examining has the ‘reversed’ cash flow pattern (i.e. receiving $100$ and $165$ in year 0 and year 2 while paying $260$ in year 1), we would only accept it if the cost of capital is either lower than 10% or higher than 50%. Why? This project with the reversed cash flow pattern has the same IRRs (10% and 50%) as the original project. You can verify this result by discounting the cash flows at 10% and 50% separately. However, the NPV profile of this project will be as below.

**Time-varying cost of capital**

If the cost of capital changes over time, NPV can easily accommodate this. Suppose the cost of capital is \( r \) for the \( t \)th year. The NPV of a project with different cost of capital over its lifetime can be given in the following equation:

\[
NPV = -I_0 + \frac{C_1}{(1 + r_1)} + \frac{C_2}{(1 + r_2)(1 + r_1)} + \frac{C_3}{(1 + r_3)(1 + r_2)(1 + r_1)} + \ldots
\]

NPV assumes that cash flows can be reinvested at the cost of capital whereas IRR assumes that cash flows can be reinvested at the IRR which is not a realistic assumption in the real world.

The superiority of NPV:
- It takes into consideration all cash flows and time value of money.
- It can be applied to deal with mutually exclusive projects.
- It can deal with non-conventional cash flows.
- It has realistic assumptions about how the capital markets work in real life.

**Activity 2.2**

Attempt Question 5, BMA Chapter 5.

See the VLE for solution.
How to value perpetuity and annuity

There are two specific cases to discuss here.

Suppose a project generates a perpetual cash flow of $CF$ at the end of each year from now until infinity. Assume the cost of capital (the discount rate) is $r\%$ per year. The present value (PV) of this project is:

$$PV = \frac{CF}{1 + r} + \frac{CF}{(1 + r)^2} + \frac{CF}{(1 + r)^3} + \ldots = \frac{CF}{1 + r}$$

Multiplying both sides by $1/(1+r)$, we get:

$$\frac{1}{1 + r} \cdot PV = \frac{CF}{(1 + r)^2} + \frac{CF}{(1 + r)^3} + \frac{CF}{(1 + r)^4} + \ldots$$

**Example 2.3**

Suppose a project requires an initial investment outlay of $100,000. It generates $10,000 each year in perpetuity. The cost of capital is 8% per year. The NPV of this project is $25,000 ($10,000/0.08 - $100,000).

Annuity is an asset that pays a fixed sum each year for a specified number of years.

**Activity 2.3**

Prove that an asset that generates $C$ each year for $n$ years has a present value $= \frac{1}{r} - \frac{1}{(1 + r)^n}$.

---

A reminder of your learning outcomes

Having completed this chapter, as well as the Essential readings and activities, you should be able to:

- describe the commonly used investment appraisal techniques
- evaluate simple investment decision process.

**Practice questions**

BMA Chapter 5, Questions 10–15.

**Sample examination questions**

RC plc has been invited to supply sub-components for a period of four years at a price of £20,000 per annum. The costing department has produced the following data and estimates relating to the production of these sub-components.

1. Material A is in stock and has an original cost of £16,000. It was originally intended for use in a product line which has now been discontinued. The materials can either be used for the production of these sub-components (sufficient for the next four years), or disposed of immediately which will incur transport and other costs of £1,400.
2. Material B will be required for the production, the current price of which is £2,800.
3. Skilled workers will be required for the production of these sub-components. Currently there is a shortage of skilled workers. RC plc can only obtain these workers by transferring them from an existing job. This current job produces a total contribution of £8,000 per year and will terminate in one year’s time. The company expects that the
labour market will improve in a year's time. By then there will be no problem around recruiting skilled workers. The current wage for these workers (who are contracted to work in RC plc until the end of this year) is £13,000 per annum.

4. A machine which is currently lying idle will be used to manufacture these sub-components. Details of the machine are:

<table>
<thead>
<tr>
<th>Original cost 2 years ago</th>
<th>£10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated life</td>
<td>10 years</td>
</tr>
<tr>
<td>Current realisable value</td>
<td>£4,000</td>
</tr>
<tr>
<td>Estimated realisable value in 4 years’ time</td>
<td>£1,500</td>
</tr>
</tbody>
</table>

The machine is routinely depreciated on a straight line basis over its useful life.

5. General overheads are to be allocated on the basis of 100% of skilled workers' cost.

6. The company's cost of capital is 10% per annum.

7. Assume all cash flows relating to revenue and costs identified in (2) and (3) arise at the end of the years to which they relate.

**Required**

a. Advise the management of RC plc whether this order should be accepted. Provide detailed calculations.

b. If the company can rent a machine to produce these sub-components, what is the maximum rental payment, payable at the beginning of each year, that the company would be willing to make without diminishing the original economic worth of the contract (as in part (a))? Discuss other factors that the management should take into consideration.
Chapter 3: Investment appraisals 2

Essential reading

BMA, Chapter 5, pp.143–47, and Chapter 6.

Further reading

ARN, Chapter 5.

Aims

In this chapter we look at some of the applications of the discounted cash flow technique in investment appraisals. In particular, we focus on the following scenarios:

• capital rationing
• inflation and price changes
• taxation

Learning outcomes

By the end of this chapter, and having completed the Essential reading and activities, you should be able to:

• apply the discounted cash flow technique in complex scenarios
• evaluate the investment decision process.

Advanced investment appraisals

BMA, Chapter 5, pp.143–47 deals with capital rationing and Chapter 6 deals with the remaining advanced topics. Before you proceed with the following section, it would be advisable to skim through those sections in the textbook.

Capital rationing

A company may have insufficient funds to undertake all positive NPV projects. Due to the shortage of funds, this restriction is more commonly known as capital rationing. There are two types of capital rationing.

Hard capital rationing

This is where the shortage of funds is imposed by external factors. This might happen in three different ways:

1. Capital markets are depressed.
2. Investors are too risk adverse.
3. Transaction costs are too high.

Soft capital rationing

This may arise when financial managers impose internal restrictions on:

• issuing equity to avoid dilution of original shareholders' value
• issuing debt to avoid fixed interest obligation and transaction cost
• investing activities in order to maintain a constant growth.
In any case, ranking projects by absolute NPV in these situations may not necessarily give the optimal strategy. Some combinations of smaller projects may give a higher NPV.

For each type of capital rationing we can further sub-divide it into two categories.

**Single period capital rationing**

If the shortage of funds is only restricted in the first year, the ranking of projects can be done by using the profitability index. Profitability index is defined as the present value of the future cash flows generated by a project divided by its initial investment. It is also called the Present Value Index (PVI) by some authors.

Profitability index, \( PI = \frac{\text{Present value of future cash flows}}{\text{Initial investment}} \)

### Example 3.1

Lion plc has the following projects:

<table>
<thead>
<tr>
<th>Projects</th>
<th>Initial Investment ($)</th>
<th>NPV ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1,000,000</td>
<td>100,000</td>
</tr>
<tr>
<td>B</td>
<td>1,500,000</td>
<td>250,000</td>
</tr>
<tr>
<td>C</td>
<td>750,000</td>
<td>50,000</td>
</tr>
<tr>
<td>D</td>
<td>500,000</td>
<td>60,000</td>
</tr>
</tbody>
</table>

The company has only $2,500,000 available at year 0. There is no other investment opportunity for the firm with any spare cash which is not invested in the above four projects.

What would be the best way to allocate the $2,500,000 funding among these four projects?

To answer this question, we first convert the NPV into PV (Initial investment + NPV) for each project. We then calculate the PI using the above formula.

<table>
<thead>
<tr>
<th>Projects</th>
<th>Initial Investment ($)</th>
<th>NPV ($)</th>
<th>PV ($)</th>
<th>PI</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1,000,000</td>
<td>100,000</td>
<td>1,100,000</td>
<td>1.10</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>1,500,000</td>
<td>250,000</td>
<td>1,750,000</td>
<td>1.17</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>750,000</td>
<td>50,000</td>
<td>800,000</td>
<td>1.07</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>500,000</td>
<td>60,000</td>
<td>560,000</td>
<td>1.12</td>
<td>2</td>
</tr>
</tbody>
</table>

In this case, the ranking of the project’s profitability is simple and straightforward. The PI suggests that for every $1 invested in Project B, it produces a present value of $1.17. When this is compared to Project A’s PI, it is obvious that for any $1 available, it is more profitable to invest in Project B than in Project A.

### When projects are infinitely divisible

The optimal plan is to invest all the available cash in the projects according to the ranking of PI. In this case, we will invest in the whole of Project B and Project D (with a combined total initial investment of $2,000,000) and in half of Project A with the remaining $500,000. The maximum NPV of this investment plan is:

\[
\text{The optimal NPV} = \$250,000 + \$60,000 + \frac{1}{2} \times \$100,000 = \$360,000
\]
When projects are not infinitely divisible

When projects are not infinitely divisible, the above investment plan might not necessarily be optimal as the spare cash of $500,000 would no longer be investable in only half of Project A. The optimal investment plan would therefore involve a strategy which gives the highest PI to the investment plan. Note that any unused cash in the investment plan, by definition, has a PI = 1 (the present value of the unused cash is the same as the amount of the unused cash itself). We can define the weighted average of the investment plan as:

$$WAPI = \sum_{i=1}^{N} \omega_i P_{i} + \omega_j$$

where $\omega_i$ is the percentage of project $i$’s initial investment to the total cash available, $P_{i}$ is the profitability index of project $i$, and $\omega_j$ is the percentage of unused cash to the total cash available.

<table>
<thead>
<tr>
<th>Weight</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A+B</td>
</tr>
<tr>
<td>A</td>
<td>0.4</td>
</tr>
<tr>
<td>B</td>
<td>0.6</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
</tr>
<tr>
<td>Unused cash</td>
<td>0</td>
</tr>
<tr>
<td>WAPI</td>
<td>1.14</td>
</tr>
</tbody>
</table>

The highest combination is to undertake both Projects A and B. This gives a weighted average PI of 1.14. It means for every $1 we invest, we will receive $1.14 of future cash measured at today’s value.

### Multiple periods capital rationing

When a firm is facing multiple periods of capital rationing, it would not be easy to resolve the optimal investment plan by using the profitability index. In this case, linear programming technique might be useful.

#### Activity 3.1

Attempt Question 7, BMA Chapter 5.
See the VLE for solution.

### Changing prices and inflation

The accuracy of NPV depends on the accuracy of the cash flow estimates. In practice, prices change for the following reasons:

- inflationary effect
- demand and supply
- technological changes
- manufacturing learning effect
- stamp duties, value-added tax and other transaction costs.

The easiest way to deal with these external effects is to incorporate the specific changes in the NPV calculation, i.e. the forecast for each period’s flows will be based on each flow item adjusted by its specific inflation to give the project actual net flow for each period.
Example 3.2
Suppose Leopard plc has a project that produces 10,000 units of a digital diary per year for the next four years. Each unit sells for $200. The unit production cost is $110. The production requires a brand new machine at year 0. It costs $2,000,000 with a scrap value of $20,000 at the end of year 4. The NPV of this project (assuming no inflation) is determined as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Machine (2,000,000)</th>
<th>Revenue 2,000,000</th>
<th>Production costs (1,100,000)</th>
<th>NCF before tax (2,000,000)</th>
<th>DF</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(2,000,000)</td>
<td>2,000,000</td>
<td>(1,100,000)</td>
<td>(2,000,000)</td>
<td>1</td>
<td>(2,000,000)</td>
</tr>
<tr>
<td>1</td>
<td>20,000</td>
<td>2,000,000</td>
<td>900,000</td>
<td>900,000</td>
<td>0.909</td>
<td>818,100</td>
</tr>
<tr>
<td>2</td>
<td>2,000,000</td>
<td>2,000,000</td>
<td>900,000</td>
<td>900,000</td>
<td>0.826</td>
<td>743,400</td>
</tr>
<tr>
<td>3</td>
<td>2,000,000</td>
<td>2,000,000</td>
<td>900,000</td>
<td>900,000</td>
<td>0.751</td>
<td>675,900</td>
</tr>
<tr>
<td>4</td>
<td>2,000,000</td>
<td>2,000,000</td>
<td>920,000</td>
<td>920,000</td>
<td>0.683</td>
<td>682,360</td>
</tr>
</tbody>
</table>

NPV 865,760

Example 3.3
Suppose the production cost for each unit will rise by 10% per year from year 2 onward. The revised NPV of this project can be determined by incorporating the price changes to the production costs in Example 3.2.

<table>
<thead>
<tr>
<th>Year</th>
<th>Machine (2,000,000)</th>
<th>Revenue 2,000,000</th>
<th>Production costs (1,100,000)</th>
<th>NCF before tax (2,000,000)</th>
<th>DF (10%)</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(2,000,000)</td>
<td>2,000,000</td>
<td>(1,100,000)</td>
<td>(2,000,000)</td>
<td>1</td>
<td>(2,000,000)</td>
</tr>
<tr>
<td>1</td>
<td>20,000</td>
<td>2,000,000</td>
<td>(1,210,000)</td>
<td>900,000</td>
<td>0.909</td>
<td>818,100</td>
</tr>
<tr>
<td>2</td>
<td>2,000,000</td>
<td>2,000,000</td>
<td>(1,331,000)</td>
<td>790,000</td>
<td>0.826</td>
<td>652,540</td>
</tr>
<tr>
<td>3</td>
<td>2,000,000</td>
<td>2,000,000</td>
<td>(1,464,000)</td>
<td>669,000</td>
<td>0.751</td>
<td>502,409</td>
</tr>
<tr>
<td>4</td>
<td>2,000,000</td>
<td>2,000,000</td>
<td>555,900</td>
<td>555,900</td>
<td>0.683</td>
<td>379,680</td>
</tr>
</tbody>
</table>

NPV 352,739

The effect of this price change to the manufacturing costs reduces the NPV from $865,760 to $352,739. If financial managers fail to recognise and take this price change into consideration, it is very likely that the project’s NPV will be grossly misstated and an incorrect decision might be reached.

Taxation
When a firm is making a profitable investment, it is likely that it will be liable for corporate tax. When evaluating a project, the tax effect must be considered. There are two issues relating to the after-tax NPV of a project:

The amount of tax payable
Different countries have different tax rules. Generally, corporate tax is payable as a percentage of the taxable profit determined by the tax authority. In principle, most items that are charged to the Statement of
Comprehensive Income (more commonly known as a Profit and Loss Account in the UK) are tax deductible. However, in some countries, the accounting depreciation for capital expenditure is not a recognised expense for tax purposes. If such a depreciation charge is not allowed, the tax authority might give an allowance for capital expenditure. For the purpose of this course, we assume that the taxable profit before capital allowance is identical to the annual net cash flow. Capital allowance is then determined as a percentage of the written down value of the capital expenditure (i.e. initial investment).

**Example 3.4**

Suppose Leopard plc in Example 3.3 pays corporate tax at 45% on taxable profits after capital allowances. We are told that the annual capital allowance is determined at 25% of the written down value at the beginning of each year.

Any unrelieved written down value in the final year of the project is given out as capital allowance in full in that year. The following table shows the calculations of the annual capital allowance and tax payable.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxable profit before capital allowances</td>
<td>900,000</td>
<td>790,000</td>
<td>669,000</td>
<td>555,900</td>
<td></td>
</tr>
<tr>
<td>Written down values (WVDs)</td>
<td>2,000,000</td>
<td>1,500,000</td>
<td>1,125,000</td>
<td>843,750</td>
<td></td>
</tr>
<tr>
<td>Capital allowances (CAs)</td>
<td>(500,000)</td>
<td>(375,000)</td>
<td>(281,250)</td>
<td>(843,750)</td>
<td></td>
</tr>
<tr>
<td>Taxable profit after capital allowances</td>
<td>400,000</td>
<td>415,000</td>
<td>638,750</td>
<td>287,850</td>
<td></td>
</tr>
<tr>
<td>Tax (45%)</td>
<td>(180,000)</td>
<td>(186,750)</td>
<td>(174,488)</td>
<td>129,533</td>
<td></td>
</tr>
</tbody>
</table>

The first year’s capital allowance is calculated as 25% of the written down value of the initial investment (i.e. 25% × $2,000,000 = $500,000). This is then deducted from the taxable profit before capital allowances (i.e. the net cash flow of year 1) to arrive at the taxable profit after capital allowances (i.e. $900,000 − $500,000 = $400,000). The tax charge for the first year is calculated as 45% of $400,000 (i.e. $180,000).

For years 2 and 3, the same approach for the calculation of capital allowances and tax charges applies. However, at the beginning of year 4, the unrelieved written down value of the initial investment ($843,750) will be treated as the capital allowance for that year. This gives rise to a negative figure for the taxable profit after capital allowances. If Leopard plc has sufficient profits from its other operations, it can use this ‘tax relief’ to reduce the tax charge for the other parts of its operations, saving the company from paying taxes of $129,533 (45% of $287,850). Given that this tax saving is generated as a result of this project, it should therefore be considered as a relevant cash flow for this project’s NPV.

**The timing for tax payable**

In Example 3.4, we determined how much tax Leopard had to pay. However, we did not discuss the second issue of when tax should be paid. Why is it important to determine the timing of tax payable? Recall the concept of time value of money. Cash flows, whether positive or negative, arising at different time periods would have an effect on a project’s NPV. Regarding tax payables, the further away from today we settle the tax liabilities, the less impact the tax will have on the project’s NPV. To see this effect, let us consider the following two cases:
Case 1: Tax payable in the same year as the profit to which it is related

<table>
<thead>
<tr>
<th>Year</th>
<th>Machine (2,000,000)</th>
<th>Revenue 2,000,000</th>
<th>Production costs (1,100,000)</th>
<th>NCF before tax (2,000,000)</th>
<th>Tax (180,000)</th>
<th>NCF after tax (2,000,000)</th>
<th>DF</th>
<th>PV (2,000,000)</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20,000</td>
<td>2,000,000</td>
<td>(1,100,000)</td>
<td>900,000</td>
<td>(180,000)</td>
<td>720,000</td>
<td>1</td>
<td>654,480</td>
<td>(7,706)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>2,000,000</td>
<td>(1,210,000)</td>
<td>900,000</td>
<td>(186,750)</td>
<td>603,250</td>
<td>0.909</td>
<td>503,860</td>
<td>818,100</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>2,000,000</td>
<td>(1,331,000)</td>
<td>790,000</td>
<td>(174,488)</td>
<td>494,513</td>
<td>0.826</td>
<td>362,170</td>
<td>503,860</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>2,000,000</td>
<td>(1,464,000)</td>
<td>660,000</td>
<td>129,533</td>
<td>381,413</td>
<td>0.751</td>
<td>260,505</td>
<td>362,170</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>2,000,000</td>
<td></td>
<td>555,900</td>
<td></td>
<td>129,533</td>
<td>0.683</td>
<td>80,440</td>
<td>260,505</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>2,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.621</td>
<td></td>
<td>80,440</td>
</tr>
</tbody>
</table>

In this case, taxes are paid in the same year as the profits to which they are related. The amount of taxes paid reduces the net cash flow of the project. Note that the tax saving in year 4 is included as a positive cash flow. The after-tax NPV of this project (after discounting) is now $-7,706, suggesting that it should not be accepted. We can clearly see in this case that the tax effect on a project's acceptability cannot be ignored as it turns the positive NPV into negative.

Case 2: Tax payable one year in arrears

<table>
<thead>
<tr>
<th>Year</th>
<th>Machine (2,000,000)</th>
<th>Revenue 2,000,000</th>
<th>Production costs (1,100,000)</th>
<th>NCF before tax (2,000,000)</th>
<th>Tax (180,000)</th>
<th>NCF after tax (2,000,000)</th>
<th>DF</th>
<th>PV (2,000,000)</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20,000</td>
<td>2,000,000</td>
<td>(1,100,000)</td>
<td>900,000</td>
<td>(180,000)</td>
<td>720,000</td>
<td>1</td>
<td>654,480</td>
<td>25,074</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>2,000,000</td>
<td>(1,210,000)</td>
<td>900,000</td>
<td>(186,750)</td>
<td>603,250</td>
<td>0.909</td>
<td>503,860</td>
<td>818,100</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>2,000,000</td>
<td>(1,331,000)</td>
<td>790,000</td>
<td>(174,488)</td>
<td>494,513</td>
<td>0.826</td>
<td>362,170</td>
<td>503,860</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>2,000,000</td>
<td>(1,464,000)</td>
<td>669,000</td>
<td>129,533</td>
<td>381,413</td>
<td>0.751</td>
<td>260,505</td>
<td>362,170</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>2,000,000</td>
<td></td>
<td>555,900</td>
<td></td>
<td>129,533</td>
<td>0.683</td>
<td>80,440</td>
<td>260,505</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>2,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.621</td>
<td></td>
<td>80,440</td>
</tr>
</tbody>
</table>

In this case, tax is payable one year after the profit to which it is related. The first year's tax is payable at the end of year 2 and the second year's tax is payable at the end of year 3 and so on. Despite this being a four-year project it now has cash flow (tax savings) arising in year 5. As we can see from Case 2, paying tax in arrears helps improve the after-tax NPV of the project. Consequently, the project should be accepted.

The timing of when tax is paid is therefore crucial for the evaluation of a project's acceptability.

Activity 3.2

Attempt Question 16, BMA Chapter 6.

See the VLE for solution.
A reminder of your learning outcomes

Having completed this chapter, as well as the Essential readings and activities, you should be able to:

- apply the discounted cash flow techniques in complex scenarios
- evaluate the investment decision process.

Practice questions

1. BMA Chapter 5, Questions 14 and 15.
2. BMA Chapter 6, Questions 22.

Sample examination questions

1. Assume that you have been appointed as the finance director of Dragon plc. The company is considering investing in the production of an electronic security device, with an expected market life of five years.

The previous finance director has undertaken an analysis of the proposed project; the main features of his analysis are shown below. He has recommended that the project should not be undertaken because the estimated annual accounting rate of return is only 12.3%.

<table>
<thead>
<tr>
<th>Proposed electronic security device project</th>
<th>Year 0 (£’000)</th>
<th>Year 1 (£’000)</th>
<th>Year 2 (£’000)</th>
<th>Year 3 (£’000)</th>
<th>Year 4 (£’000)</th>
<th>Year 5 (£’000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment in depreciable fixed assets</td>
<td>4,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative investment in working capital</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>600</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>Sales</td>
<td>3,500</td>
<td>4,900</td>
<td>5,320</td>
<td>5,740</td>
<td>5,320</td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>535</td>
<td>750</td>
<td>900</td>
<td>1,050</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>1,070</td>
<td>1,500</td>
<td>1,800</td>
<td>2,100</td>
<td>1,800</td>
<td></td>
</tr>
<tr>
<td>Overhead</td>
<td>50</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td>576</td>
<td>576</td>
<td>576</td>
<td>576</td>
<td>576</td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td>900</td>
<td>900</td>
<td>900</td>
<td>900</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>Taxable profit</td>
<td>369</td>
<td>1,074</td>
<td>1,044</td>
<td>1,014</td>
<td>1,044</td>
<td></td>
</tr>
<tr>
<td>Taxation</td>
<td>129</td>
<td>376</td>
<td>365</td>
<td>355</td>
<td>365</td>
<td></td>
</tr>
<tr>
<td>Profit after tax</td>
<td>240</td>
<td>698</td>
<td>679</td>
<td>659</td>
<td>679</td>
<td></td>
</tr>
</tbody>
</table>

Total initial investment is £4,800,000. Average annual after-tax profit is £591,000.

All the above cash flow and profit estimates have been prepared in terms of present day costs and prices (i.e. no inflation), since the previous finance director assumed that the sales price could be increased to compensate for any increase in costs.

You have available the following additional information:

a. Selling prices, working capital requirements and overhead expenses are expected to increase by 5% per year.

b. Material costs and labour costs are expected to increase by 10% per year.
c. Capital allowances (tax depreciation) are allowable for taxation purposes against profits at 25% per year on a reducing balance basis.

d. Taxation on profits is at a rate of 35%, payable one year in arrears.

e. The fixed assets have no expected salvage value at the end of five years.

f. The company’s real after-tax weighted average cost of capital is estimated to be 8% per year, and nominal after-tax weighted average cost of capital to be 15% per year.

Assume that all receipts and payments arise at the end of the year to which they relate, except those in year 0, which occur immediately.

**Required:**

a. Estimate the net present value of the proposed project. State clearly any assumptions that you make.

b. Calculate by how much the discount rate would have to change to result in a net present value of approximately zero.

c. Compare and contrast the NPV and IRR approaches to investment appraisal.